STN PUB
NRM
A.R.
1934

R
Investigative Program
Northern Rocky Mountain Region

July 13, 1935.

ANNUAL REPORT FOR 1934

AND

PROGRAM FOR FISCAL YEAR 1936

LYLE F. WATTS, Director.

C O N T E N T S

	Page
Introduction	1
Investigative Council	2
Matters of General Interest	2
Civilian Conservation Corps	2,3
National Industrial Recovery Act	3,4
Federal Emergency Relief Administration	4
Selection of Research Areas	4
Tepee Creek Natural Area	4
Rochester Basin Experimental Range	4,5
Vigilante Experimental Range	5
Clearwater Experimental Forest	5,6
Pleasant Valley Experimental Forest	6
Progress and Plans by Lines of Work	7
Forest Management	7
Silviculture	7
White Pine Reproduction Study	7,8
White Pine Methods of Cutting	8
Ponderosa Pine Methods of Cutting	9
White Pine Growth and Yield	9
Ponderosa Pine Growth and Yield	9
Larch-fir Growth and Yield	9
White Pine Thinning Methods	9,10
Ponderosa Pine Thinning Methods	10
Botanical Studies	10
Reforestation	10,11
Fire Research	11-13
Range Research.	13-15
Forest Products	15-18
Forest Survey	18-22
Progress Report	23
Experiment Station Personnel	24-26
Publications	27
Published Since Last Report	27,28
Submitted for Publication	29
In Preparation or Proposed for F. Y. 1936	30-32

INTRODUCTION

The major shift in national thinking of the last few years from a "laissez faire" attitude to one of coordinated planning has greatly increased the work and responsibilities of this Station. The administration of Article X of the Lumber Code called for every bit of available information usable in working out and revising woods-practice rules. Although the NRA has now been discontinued, the impetus given to selective logging, based on sound economic principles, should continue and should have the effect of leaving our future private cut-over lands in better condition to produce another crop.

The many organizations concerned with land-use planning have placed demands on the Station for all the help we can give. Data, type maps in particular, from the Forest Survey are constantly sought after. It is unfortunate that more of the area has not been completed in order that the possibilities of future management could be adequately stressed. The data on artificial reseeding of abandoned dry farms are constantly in demand for use in eastern Montana, and our results in managing range land in accordance with proper stocking are finally getting across. It is particularly satisfying to have the various Federal financing agencies request and use these data in connection with land and livestock loans and land valuations.

The impetus given to forestry by increased programs for blister rust control, stand improvement, and planting similarly require most of the data available from our silvicultural research. Unfortunately, work in this field has of necessity been confined to the white-pine type and, therefore, the service we can give in this field is greatly curtailed.

Fire research results are placed in use currently. The fire danger measurement technique and procedure which has been worked out by the Station is now used as the basis for current fire control organization changes and for placing restrictions on the use of the Forests during the fire season, while the fire control planning project has been absorbed completely by the Region in building up to the new objective of corralling all fires in the first work period.

The floods in northern Idaho and the dust storms of eastern Montana have both emphasized the need and brought to us demands for information on the effect of vegetative cover on streamflow and erosion.

Altogether, the requests for usable data at last exceed our supply, and we are often embarrassed by the lack of information which results from having had too meager financial support in the past and of still having too limited allotments to attack even the most pressing problems.

INVESTIGATIVE COUNCIL

The annual formal meeting of the Regional Investigative Council was dispensed with this year and in its place small group conferences to consider specific projects were substituted. The continued uncertainty of funds for carrying out the rather elaborate plans for emergency expansion occasioned one delay after another in scheduling a meeting date until the field season was on, and the interested personnel were to a large extent in the field. Inasmuch as the primary purpose of such a meeting is that of considering plans for the season, it is just as well that a meeting was not held. The exhaustion of NIRA funds and the uncertain status of ECW research funds, together with the failure to allocate a sufficient amount of usable ERA money, all tend to nullify the conferences held and the plans prepared for the year's program of work.

MATTERS OF GENERAL INTEREST

The past year, as in 1933, proved to be one of further reductions in regular appropriations, but of increased total expenditures due to fairly liberal allotments of emergency funds. In contrast to 1933, however, we were fully prepared for this temporary expansion and had a sufficient nucleus of trained temporary men to amply supervise the various projects.

CIVILIAN CONSERVATION CORPS

The Station was particularly fortunate during 1934 in the allocation of Civilian Conservation camps. One entire camp was allocated each to Priest River Experimental Forest, Deception Creek Experimental Forest, and Coram Experimental Forest. While the largest single work project in each instance was the construction of utilization and protection roads, material progress was made in many other ways. The enrollees, under the direction of carefully selected technicians, established thinning and stand improvement plots, treated a considerable area of old burns

to reduce the fire hazard, eradicated the ribes from the entire area of the two white pine experimental forests, poisoned rodents, accomplished a number of improvements on the station grounds, fireproofed and cleaned up many miles of roadside, planted trees on poorly stocked areas and in the arboretum, and assisted in many other improvement and research projects. From four to eight selected enrollees were assigned during the entire year for office work at the Station headquarters at Missoula.

Present plans call for a full camp at Priest River, not only for the present summer, but for the winter of 1935-36 as well; a full camp at Deception during the summer, and approximately half a camp at Coram for the winter of 1935-36. With this amount of CCC help assured the road and trail systems on these experimental Forests will be completed in a reasonable period and a vast amount of other worth-while work will be done. Unfortunately, the camp allotments for overhead, equipment and materials, and miscellaneous expenses have now been so greatly reduced that much otherwise logical work, including station buildings, cannot be attempted. CCC assistance at Miles City has been impossible to obtain due to the long distance from any established camp.

NATIONAL INDUSTRIAL RECOVERY ACT

Funds allotted to the Station under the National Industrial Recovery Act made possible a vast amount of work, not only in the way of improvements but on research projects as well.

The major improvement items were a 150-foot fire-weather observation tower, a four-room cottage, and the completion of 13½ miles of power line from the town of Priest River to the experimental forest at Priest River; one five-room and one three-room dwelling, a shop, a five-stall garage, a gas house, water system, and landscaping at Deception; and a two-stall garage and a five-room dwelling at old Fort Keogh.

Additional projects not covered elsewhere under the research progress section of this report were an intensive timber survey of the Priest River, Deception and Coram Experimental Forests, and the preparation of exhaustive reports in each instance; and an intensive grazing-erosion survey of the Rochester Basin area of 101,266 acres of spring-fall foothill range under consideration for an experimental range. Due to the fact that this area contains a large amount (approximately 60%) of public domain, its formal dedication to research must

await a decision as to a division of responsibility between departments.

FEDERAL EMERGENCY RELIEF ADMINISTRATION

The only Federal Emergency Relief project undertaken by this Station was an erosion-control project at old Fort Keogh. Approximately $3,500 of FERA money was used in the construction of two rock jetties in the Yellowstone River adjacent to our experimental field of reseeding plots. The object of the project was to control river-bank cutting by the use of jetties and by the planting of willows and various grasses on the river bank immediately below the jetties. These high river banks were reduced from perpendicular to moderate slopes. Half of the slope banks were seeded to grass in the fall of 1934 and the other half in the spring of 1935. Willow cuttings were planted along the water edge at the lower end of the slope banks. While the results from this work will not be known for several years, it is hoped that the reduction in acreage used for intensive artificial reseeding studies can be halted.

SELECTION OF RESEARCH AREAS

Material progress in rounding out the system of experimental forests and ranges and natural areas was made during the past year.

TEPEE CREEK NATURAL AREA

In the white pine type on the Kaniksu National Forest, a beautiful area of 746 acres, largely an overmature climax forest, was selected as a natural area. The formal report is awaiting approval by the Washington Office. This area should, by all means, be retained permanently in its virgin condition, as it is one of the few remaining really suitable areas of virgin old growth white pine adjacent to Priest Lake and, in fact, on the Kaniksu National Forest.

ROCHESTER BASIN EXPERIMENTAL RANGE (Proposed)

The foothill spring-fall range area previously mentioned was selected for an experimental range and covered by

an intensive grazing-erosion survey. This area is typical of the spring-fall ranges of Montana and is ideally suited for experimental work, not only for this reason, but also because of its accessibility both to the railroad and to main traveled highways. The formal establishment report has been prepared and submitted to Washington, but approval must await a final decision as to the ultimate division of responsibility for this type of Public Domain watershed land.

VIGILANTE EXPERIMENTAL RANGE (Proposed)

There are three major range conditions which must be studied and the use of which must be correlated before a sound, balanced range-use program for Montana can be developed. These are the short-grass ranges of the Northern Great Plains, the foothill spring-fall ranges of central Montana and the high mountain summer ranges on the National Forests. The first condition is covered by the existing station near Miles City, the second by the Rochester Basin area discussed above, and the third by the Vigilante area selected on the Beaverhead National Forest. This area, located on the Ruby River District of the Beaverhead National Forest consists of about 7,500 acres of typical summer range, or sufficient to carry 125 head of cattle and 1,500 head of sheep for the usual summer grazing season. Agreement between the Forest, the Region, and the Experiment Station on location and boundaries has been reached and the formal establishment report will be submitted to Washington for consideration and final approval within the next few days.

CLEARWATER EXPERIMENTAL FOREST (Proposed)

An area in the south end of the white pine range is badly needed as a center of work for this most productive subregion and for the prevailing 100-120-year age class there represented. During the past year, some twelve areas have been examined, but no suitable tract could be found on National Forest land. An area of two sections owned by one of the large timber companies was examined and found to be ideal in every way and could be purchased at a reasonable price for the commercial stumpage involved. A formal report recommending its acquisition as an experimental forest has been prepared and will be submitted if and when the allotment of funds for acquisition are large enough to make possible a sizeable allocation for this purpose.

Another nearby area owned by the State of Idaho was located, examined and found to be fairly suited to our needs.

The State officials responsible for State lands in Idaho favor the dedication of this timber tract for research use by the Northern Rocky Mountain Station, but the restrictions, legal and otherwise, which would have to be written into the agreement make the selection of the area advisable only as a last resort. It is not probable that either area can be acquired through exchange due to the fact that no legislation has been enacted authorizing in Idaho the exchange of National Forest land or stumpage for land now outside the National Forest boundary, because timber sale receipts in Idaho are obligated up to the allowable exchange percentage for years ahead, and because the National Forests have no white pine stumpage equally as desirable to hold as these two tracts.

A desirable area of overmature climax white pine on National Forest land, suitable for a natural area, has been located only a few miles from either of the above two white pine tracts. Formal recommendation for its dedication as a natural area is being withheld because it is desired to have the experimental forest and natural area for this subregion as close together as possible.

PLEASANT VALLEY EXPERIMENTAL FOREST (Proposed)

The one other urgently needed research center is an experimental forest in the ponderosa pine type. Approximately two weeks was devoted to an examination of a large number of areas suggested as possibly suitable for this purpose. Unfortunately, the bulk of the good accessible ponderosa pine timber passed to private ownership prior to the creation of the National Forests and, therefore, no area at all suitable in public ownership was located. Two desirable areas belonging to the ACM Lumber Company, both outside the National Forests, were examined and the manager of the company was contacted regarding possible exchange or purchase. One area is now under contract to log and was not for sale. The other, Paradise Valley, may be acquired if agreement as to values can be arrived at. There is little probability that an exchange can be consummated because of the small volume of timber sales in Montana. A formal report recommending the selection of this tract as a purchase area by the National Forestry Reservation Commission has been prepared and is being held pending the allocation of a sizeable fund for acquisition of virgin timber in the West.

PROGRESS AND PLANS BY LINES OF WORK

FOREST MANAGEMENT

SILVICULTURE

White Pine Reproduction Study

This group of studies, now in their tenth year, has answered many of the pressing questions relative to white pine establishment and survival. Three phases of the problem have been studied. (1) An intensive investigation of the cause of seedling mortality during the first two years. (2) The rate of seedling establishment on areas cutover under various silvicultural methods and on various sites and exposures. (3) The history of the seed crop from date of flowering to germination, including such things as size and frequency of cone crops, the relationship of type and size of tree to cone production, the distance of seed dispersal, and the viability of seed stored in the duff for various periods.

To study these problems, there have been established 34 permanent plots, 1,149 quadrats, 4,696 tagged trees, 102 seed traps, several seed-stored-in-the-duff installations, and a large number of small plots of sowed seedling dealing intensively with specific causes of seedling mortality. Certain phases of the study have reached the point where definite conclusions can be drawn and where they can be curtailed, at least temporarily, in favor of more urgent phases of the white pine silvicultural problems. This is particularly true of the intensive seedling mortality study and the more extensive quadrat study of rate of seedling establishment on cutover areas. The whole field of white pine silvicultural research was reviewed and considered during the past winter by the entire silviculture staff, and, as a result, new project plans were prepared, placing more stress on the important problem of seedling development. The completion of the analysis of all available white pine data and the preparation of the several bulletins now approaching completion, coupled with several personnel changes, offered an excellent opportunity for a critical analysis of our program.

The following publications covering certain phases of this project are well along. (1) Haig's bulletin, "Factors Controlling Initial Establishment in Western White Pine," has been submitted to and accepted for publication by the Yale University in completion of the requirements for his doctorate. (2) Haig and Weidman's proposed U. S. Department of Agriculture Technical Bulletin, "Natural

Reproduction of Western White Pine," is approximately 75% complete and will be ready for review and editorial criticism by early winter. (3) Haig and Wellner's proposed U. S. Department of Agriculture Technical Bulletin, "Method of Cutting; Its Effect on Reproduction in the White Pine Type," is 75% in final copy and should be ready for review by November 30 at the latest. The publication of these three bulletins will clear our present program for major silvicultural publications, although there remains unpublished material for numerous articles for the Journal of Forestry, Ecology, and Journal of Agricultural Research.

White Pine Methods of Cutting

Two permanent plots at Deception were added to the 26 previously established to determine the suitability of various methods of cutting in the white pine type. These two new plots plots investigate the possibilities of an entirely new approach to the problem of reducing the shade cast after cutting by the trees of inferior species which are left. Normally the amount of hemlock, white fir, and cedar overwood and understory must be greatly reduced if white pine is to become established and make satisfactory development. Using CCC labor, this sanitation work was done prior to the removal of the merchantable white pine to determine whether the light conditions thus created will favor immediate establishment of a fully stocked stand of white pine seedlings. As soon as the area is fully stocked with white pine seedlings, all of the merchantable white pine will be removed in one clear cutting. It is highly desirable in this type that the interval between cutting and the closing of the canopy of the new forest be as short as possible in order that the high cost of ribes eradication and maintenance may be reduced to a minimum. If this method promises to shorten the period materially, it will be repeated in the hopes that the lowered cost of ribes control will more than offset the additional cost of the silvicultural treatment.

Three additional methods of cutting plots will be established this year in connection with the sale of one and one-half million feet of white pine lumber at Deception Creek. In this sale, we are going back to the system of clear cutting in strips which was so successful on certain sites in early Forest Service timber sales. The main difference is that we are treating the reserved strip by removing the hemlock under and over story in the expectation that not only the clear-cut strips, but the reserve strip as well will reproduce and thus permit of removal of the reserve in a very few years.

The yield phase of this study is covered by the 28 plots already established, the new plots discussed above, and by a strip study of 32 old cuttings made by Haig several years ago. These data will be analyzed and prepared for publication next winter.

Ponderosa Pine Methods of Cutting

Other than the installation of 20 reproduction quadrats in the three permanent plots near Greenough, Montana, and their current examination, no further work on this project was done last year or is contemplated for 1935.

White Pine Growth and Yield

This project includes 31 permanent and 56 semipermanent plots, established mostly between 1922 and 1926. Remeasurements are made at five- and ten-year intervals to determine growth, yield and development of young stands.

Ponderosa Pine Growth and Yield

This study is a part of the interregional project for the preparation of even-aged normal yield tables by the Pacific Northwest Forest Experiment Station. Thirty-eight plots were established and measured by this station prior to 1934. During the past year, data from 153 additional plots, of which 31 plots were in the Black Hills, were secured. This makes a total of 275 plots, including the 84 selected by Mr. Behre some ten years ago, and provides an ample base for all sites and ages represented in this region. The data have been furnished to Mr. Meyer, who is responsible for the preparation of the interregional yield tables.

Larch-Fir Growth and Yield

This project was initiated in cooperation with Region One in 1932 to determine the rate of growth of residual stands of larch-fir. During the past year, 56 temporary plots were added to 30 plots previously established. It is now planned to select and obtain data from about 50 additional plots during the late summer and fall and to analyze the data and prepare a report for publication next winter. The data are very badly needed for the growth phase of the Forest Survey and for silvicultural management on National Forest sales.

Work on the collection of data for the preparation of an even-aged normal yield table for this timber type is being initiated this season by the Forest Survey. A discussion of this subproject appears in the statement for the growth phase of the Forest Survey and will not be repeated here.

White Pine Thinning Methods

Information as to proper thinning technique and the results with various ages and condition of stands is very

meager indeed. Work under way by the CCC camps and with other emergency funds is being carried on with entirely too little basic information. To meet this need, the Station has been establishing thinning plots whenever time could be found. Eleven plots were established between 1914 and 1926, 14 plots in 1933, and a Latin square installation, including four replications of six treatments and a check, as well as one individual plot with check in 1934. While too much emphasis must not be given to this phase of silviculture at this time, it is essential that progress be made. One new series of thinning plots will be installed at Deception, using CCC labor during the current season.

The records from the remeasurement of the 11 plots established at Priest River during the early years of the station will be analyzed and prepared for publication during this year.

Ponderosa Pine Thinning Methods

The only additional work done on this project during the past year was the remeasurement of six plots established on the Custer Forest in 1918 and 1921. No additional work is contemplated during 1935.

Botanical Studies

Progress is being made in establishing an arboretum at the Priest River Experimental Forest. Blocks varying from 1/4 to one acre in size have been laid out for planting with all coniferous species which will survive in this region. Prior to 1935, thirty-four blocks had been planted and eighteen additional blocks were planted in the spring of 1935. The extreme drought of the past few years has caused heavy losses and has necessitated a large amount of replacements each year.

The racial variety plots of ponderosa pine from 18 widely separated localities established in 1911 to 1917 were all reexamined and remeasured last year and a detailed photographic record was secured. This material will be prepared for publication during the coming winter.

Reforestation

The Region One planting program is being greatly expanded by enlarging the Savenac Nursery to increase the output from five million to fifteen million trees per year and plans have been made for the development of a second nursery in the white pine type on the St. Joe Forest.

Because of this increased activity in forest planting, it is essential that research in this field be reinstated after a lapse of several years. Under the proposed

program, it is planned to include not only the area suited for potential commercial production, but a considerable portion of the denuded and non-restocked burns in the protection type as well. Some two million acres must be planted. A large amount of research to determine the suitable species, best technique, and plantable site is needed.

FIRE RESEARCH

Results of research by the Northern Rocky Mountain Station devoted to fire control planning and to fire danger measurement have been found so satisfactory that they have been applied on the Forests even before the facts could be published. This has been especially true in fire control planning where the methods originated and developed by Hornby were actually applied to whole groups of National Forests while they were being developed. These systematic methods of determining the man power and physical facilities needed for adequate fire control were so obviously superior to the former practice of furnishing coverage according to the opinion of local men that the National Park Service and some private and State timber protective organizations furnished the men for a similar study of their lands under Hornby's supervision before he had had time to complete the job for the National Forests.

As a result of the application of these systematic methods, the National Forests of Region One are now covered by lookouts, smokechasers, and transportation facilities to furnish reinforcements even more efficiently than in the past, and at a reduction of 20 percent in the annual cost of maintaining the fire control organization. The distribution of fire control effort has also been improved, so that expenditures are now in proportion to the probability of fires starting, the value of destructible resources, the rate of spread of fire, and the difficulty of control.

When such extensive and detailed work is done under pressure, as this was done, there are usually opportunities of refinement, and often minor phases possible of improvement, brought to light by the test of experience. It is, therefore, advisable to continue research in fire control planning for the next several years in order to insure full use and value from the basic work so well commenced. Some revisions of the methods may also be necessary in order to meet changed standards or objectives in fire control.

The research devoted to the measurement of fire danger has likewise been put into actual practice very extensively during the past year. Whereas the practice of burning road construction slash, smoking within the Forest,

entry of campers and tourists, and the expansion of the Forest protective organization used to be determined solely on the basis of estimate and opinion of prevailing fire danger, these practices and some others are now largely controlled in Region One on the basis of fire danger measurements and the carefully computed class of fire danger. Like the systematic methods of fire control planning, these research-developed methods of measuring fire danger put all Forests on a uniform and scientific basis, reducing the element of guesswork to a minimum and thereby obviating the errors so inherent in unstudied opinion.

The research-developed methods of measuring fire danger are not untested, however. Some of these methods have been used for over ten years on some Forests, and even the more recently developed methods of integrating the numerous factors of fire danger, by use of the danger meter, has been tested during the past two years on all the fire Forests in Region One. Both the United States Indian Service and the Park Service are now using the methods of measuring fire danger developed by the Northern Rocky Mountain Forest and Range Experiment Station. Some 84 stations are using these methods throughout the country.

By use of these methods, and the system of rating fire danger on a numerical scale, it is now possible to express fire danger in easily understandable and comparable terms. This could not be done previous to the origination of these methods. This permits accurate description of the character of each fire season for either a single Forest or an entire Region. On this basis, it is possible to compare the results of fire control with the conditions encountered and thereby determine whether or not the fire control effort and expenditures have been efficient. Such a determination must be made by Regional Foresters, the Chief of the Forest Service, Congressmen, State Boards of Forestry, and directors of private timber protective associations if they are to pass sound judgment upon the expenditure of funds for which they are responsible.

Although plans had been made for expanding several features of this fire research, which are in need of more investigation, additional funds have not been made available. The several phases of the project are, therefore, being continued with the existing facilities. By turning over to the Forests the responsibility for supervising the operation of their own stations, by eliminating all unessential phases of this project, and by other means, it has been possible to extend one feature of the work and to initiate one new and very important phase during the past year. The phase extended is the study of fire danger differences according to altitude and on north versus south slopes. The new study is an intensive investigation of the

effect of vegetative condition on the rate of spread of fire. Both of these are basic to the accurate rating of fire danger and to the most efficient placement of men to insure adequate fire control at minimum cost.

RANGE RESEARCH

The rather liberal allotment of emergency funds for range research during the past year has enabled the station to make substantial progress in this field in spite of the small amount of regular funds available. Prior to 1934, major emphasis was placed on the project designed to determine the best management of short-grass ranges in the northern Great Plains region with some experiments in artificial reseeding of plowed and abandoned dry-land ranches. Under the emergency expansion, the major project was materially strengthened and the artificial reseeding project was attacked in a more nearly adequate fashion.

During 1934, the most serious drought of record was experienced in eastern Montana. The total precipitation at Miles City was only 5.51 inches or approximately 40 percent of the normal. This condition placed both the range management and artificial reseeding projects to the most severe test.

The value to the livestock operator of properly stocking range lands, especially during drought years, has been amply demonstrated. The three lots of 20 cows each and their pastures have now been used in this experiment for three years. One lot of cows has been grazed continuously on pastures of such size that for a normal year, they were 25 percent overgrazed; one lot has been on pastures which were approximately properly grazed; and one lot has been on pastures which were about 25 percent underutilized. Although the average weight per cow of each lot differed by only about eight pounds when the experiment started in 1932, those on overgrazed pastures have weighed consistently since that time 40 or more pounds per head less than those on the more lightly stocked pastures. At the close of the nearly normal 1933 season, this difference in average weight per head was nearly 90 pounds. In 1934, due to the extreme drought, it was necessary on July 20 to start feeding hay to the cows on the overgrazed pastures, while those on properly grazed and understocked pastures did not require supplemental hay feeding until September 5 and September 14, respectively. By November, when all cows were removed to the feed lot, the cows on overgrazed pastures had been fed more than a ton of hay per head, while those on the undergrazed pastures had used less than 850 pounds.

The effect of overgrazing, as shown by this experiment in 1933 and 1934, has been to reduce the calf crop from

97½ percent to 75 percent; reduce the average weight of calves at birth from 74.9 pounds to 68.4 pounds, and at weaning time from 300.7 pounds to 263.4 pounds; and to increase the average cost of calf weight produced from 2.44¢ to 3.84¢ per pound. Obviously, the overgrazing of range land is extremely costly even when the effect on the vegetative cover is not considered.

The effect of the three intensities of use has not as yet been seriously reflected in the density of the plant cover. However, the drought of 1934 caused a reduction in the volume of forage produced to 25 percent of normal and in the density of cover to 72 percent of that for 1933. In certain forage types, a reduction in density of as much as 70 percent is shown by a limited number of quadrats recharted during the current season. Thus, overgrazing not only damages the range, but significantly increases the cost of producing range cattle.

Results from the artificial reseeding project permit a preliminary conclusion that a very great part of the more than four million acres of plowed and abandoned dry farm land in Montana can be reseeded at a cost which will be justified by increased carrying capacity and by reduced wind and water erosion. To date, approximately 1,100 acres, in tracts of from one to forty acres, have been seeded. Experiments with from one to twenty species of grasses are being conducted at Old Fort Keogh, in the Forest School Nursery at Missoula, on several National Forests, and under cooperative agreements on privately owned, plowed and abandoned dry farm land in 22 central and eastern Montana counties. About 425 acres of the test areas, seeded in the fall of 1933 and spring of 1934, mostly without soil preparation, suffered the full effect of the 1934 drought, and yet, success is indicated by incomplete examinations on more than 32 percent of the area. The plots sown in the fall of 1934 and spring of 1935 now promise to give 60 to 75 percent success.

While 20 species of grass are being used in this experiment, crested wheat grass, native to a locality of similar climate in Siberia, promised to be best suited to this region.

An increase of $20,000 in regular funds for range research becomes available on July 1, 1935. This will not only adequately finance the continuation of the cattle phase of the short grass range management study at Fort Keogh, but will provide for the initiation of a similar study with sheep. While it is not sufficient to finance desirable expansion in the very important artificial reseeding project, it will permit us to continue the intensive studies in this field now under way at Fort Keogh and in Missoula, as well

as the necessary examination of the plots on privately owned and abandoned dry farm lands throughout eastern and central Montana.

One entirely new project will be initiated. Although some very valuable results have been secured in Region One from well-planned and executed administrative studies, no formal research to investigate the best management of high mountain summer ranges on the National Forests has yet been undertaken. During the past year, an area on the Beaverhead National Forest suitable for this purpose was selected jointly by the Supervisor, Region, and Experiment Station. An immediate start is being made to study this problem with both cattle and sheep. While funds will be too limited to permit of as effective work as is urgently needed, it is thought best to make the start in the hopes of more liberal appropriations next year.

FOREST PRODUCTS

The Inland Empire is primarily a forested region. Lumbering is and must continue to be the major industry. Approximately 35 percent of the 105 billion board feet of merchantable timber is privately owned. An average of $1\frac{1}{4}$ billion feet of lumber is being cut each year. Sixty percent of the entire cut now comes from these private lands. Due to economic conditions and for lack of sound information on production costs and returns, most private operators are liquidating their investments in stumpage as rapidly as possible by clean cutting. In parts of the region, cutting has progressed so far that sustained yield management on anything like the present cut is already impossible. The field for economic investigations in forest management and utilization is broad and the critical situation at the present time demands increased study along this line. . .

Forest products research, as now handled by the Northern Rocky Mountain Experiment Station, is designed to be of maximum service to the industry and the government in the field of economics in forest products production. The projects now under way are carried under the following main designations: (1) Logging and milling studies; (2) Woods and mill utilization; (3) Species utilization; (4) Wood preservation; (5) Forest statistics, and (6) Special studies.

The logging and mill studies - (1) selective logging and (2) logging output studies - provide information on the important phases of forest products production. The final results of the selective logging studies will show for each commercial type in the region and for individual holdings,

the cutting limits and the utilization standards necessary to provide a reasonable profit for the operator and leave the land in a productive condition for future yields. The logging output studies are designed to measure the output of new logging equipment and new logging methods. Eight selective logging studies have been undertaken - five in the ponderosa pine type of western Montana, two in the white pine type, and one in the larch-Douglas fir type. During the past year, the results of the ACM 1932 study in the ponderosa pine type were made available in a bulletin published in cooperation with the University of Montana and the State Forester of Montana. This bulletin, "Application of Selective Logging to a Ponderosa Pine Operation in Western Montana," has helped materially in demonstrating to the operator who is liquidating his stumpage at a rapid rate the financial disadvantages of logging and milling the smaller trees. Through the study, an economic tree classification for ponderosa pine was evolved which aids the operator materially in selecting the trees to be cut. This information was made available for use in a trade journal article entitled "Why Selective Cutting of Ponderosa Pine Pays." During the year also, the data collected on a logging-milling study in the Idaho white pine type of North Idaho was compiled and analyzed and the results published in a trade journal article. This study gives the production costs and production values for the matchplank and commercial lumber produced from white pine trees of different diameter. White pine trees below 13 inches in diameter breast high cannot be removed at a profit to furnish matchplank and commercial lumber. This minimum cutting limit checked the one set up by the North Idaho Forest Practice Committee under Schedule C of the Code. In addition, the office compilation for a tie study in the larch-Douglas fir type was completed and a rough draft of the scientific report prepared. The field and office work was completed for the logging output study on "tractor and arch" skidding in ponderosa pine and the results made available.

Plans for F.Y. 1936 contemplate the completion of the tie study in the larch-Douglas fir type and the publication of results. A new selective logging study in the Idaho white pine type will be inaugurated with plans to complete all phases of the study during the year. This study will furnish the production costs and values by tree sizes for the younger age classes of white pine lumber now being logged in many sections of the Region. The accumulated results of the selective logging studies in western Montana will be applied to the operations of the Anaconda Copper Mining Company to determine the possibilities and limitations of sustained forestry practice on their timber lands. The ACM Company is the largest private owner of timberland in Montana. The timber is being cut primarily to provide

lumber and round mine timbers for the company's mines and smelters, but a good amount of commercial lumber is also produced each year. Logging output data on motor trucks and tractors will also be brought up to date during the year. The section of Forest Products at this Station has never received any of the emergency funds allotted to other projects, so it is not seriously affected by the present financial situation. Plans for an increased program of work, based on the use of emergency funds, were made, but these can be discarded without affecting the schedule of work planned above with the regular staff.

The woods and mill studies furnish information pertaining to overrun data, efficiency comparison of logging and mill equipment, waste investigations, and depreciation studies. The results of previous studies on overrun, sawmill efficiency, residual wood after logging, breakage in felling and depreciation through river driving, gravity chuting, and fire have been made available to the northwestern lumber industry. No special program of work was planned under this project during the past year, and no additional work will be done during F.Y. 1936 other than the incidental time required for inquiries from various agencies concerning woods and mill utilization within this Region.

The species utilization studies are designed to promote the good utilization of certain little-used species, thereby increasing the economic value of the source of our present timber supply. Bulletins on western hemlock, western larch, and white fir have been published as a result of cooperation by this office, the Forest Products Laboratory, and the Pacific Northwest and California Experiment Stations. Preparation of the manuscript on lodgepole pine has been postponed because of recent serious insect losses in the species and the present economic conditions in the lumber industry.

Cost data and other information resulting from the Regional wood-preserving studies have been widely used in treating telephone poles, fence posts, and stubs required in the construction and maintenance of Forest Service improvements. Other Federal agencies, as well as some commercial companies and private individuals, make use of the basic information obtained from these studies. Many of the service test studies have been under observation for a great many years and are providing the only reliable data that can be obtained on the durability of treated and untreated woods in actual service and the efficiency of various preservatives and methods of treatment. The project now includes 20 installations distributed widely throughout the Region. More than 20,000 test timbers consisting of full-sized railway ties, telephone and electrification poles, pole stubs, fenceposts, and mining timbers are included. During the past year,

eight installations were up for examination. These were examined and reports prepared. Collection of service records for treated and untreated timbers will be continued. Seven test installations are up for examination during F.Y. 1936.

Current data are obtained on the amounts produced, production costs, and selling values of the forest products cut and manufactured within the region. These data are used in figuring the sale value of Government-owned timber by the Federal agencies in Washington, Oregon, Idaho and Montana. Statistical information is used extensively by the Government agencies and the industry within the Region in many special reports. The actual projects consist of (1) a canvass of all the sawmills and producers of miscellaneous timber products within the Region to obtain the production figures on lumber, lath, shingles, and miscellaneous timber products, (2) the collection of lumber and timber products price statistics for northern Idaho, eastern Washington, and western Montana, in sufficient volume to indicate periodic trends in the selling price of lumber (wholesale and retail), stumpage logs, cedar products and ties, and (3) the collection of detailed logging and manufacturing costs from all of the important lumber companies in North Idaho, eastern Washington, and western Montana by personal contact. Statistics were collected and compiled for all the activities outlined above during the past year. There will be a continuation of all activities in the project during F.Y. 1936.

FOREST SURVEY

The Forest Survey organization of this Station plans as its first unit to cover the Inland Empire region of the Pacific Northwest. The Inland Empire region includes Montana west of the Continental Divide, Idaho north of the Salmon River, and Spokane, Stevens and Pend Oreille counties in northeastern Washington. Within this unit, there are approximately 26 million acres of forest land to be covered by the survey. The Inland Empire is primarily a forested region, approximately 78 percent of its gross area being forest land. Lumbering and mining are the foremost industries within the region and many of the communities are entirely dependent upon the forests for their support. Cutting of the accessible forests has gone forward at such a rate that in some sections of the region, sustained yield management under the present mill set-up is already impossible. Forest fires have taken a heavy toll of the future timber supply and in parts of the region, epidemic insect losses have been heavy. Profitable agriculture is limited to relatively narrow valleys and adjacent bench lands, and most attempts at farming in the cutover lands outside of these areas have been unsuccessful. Planned use of the land is becoming an increasingly important problem.

Collection of cruise data for the Survey was started in January 1932. Field work on a small scale was initiated in May 1932. Since that time, the work has progressed on an increasing scale, both in the field and office. In 1933, a total of six field mappers were employed for part of the season. During the summer of 1934, an average of 30 men mapped in the field and cruised and about the same number were employed on office compilation during the winter and spring of 1935.

On the accompanying tabulation, under the heading "Percentage of Job Completed," are listed the four major divisions of the work of the inventory phase of the survey. "Collection" represents the work of assembling and sorting the cruise information available from the various sources. "Field Mapping" is the work of covering areas for which no satisfactory information is obtainable and supplying missing data such as age and site, on areas of mature timber where volume data alone have been obtained. "Adjustment Cruising" consists of checking the collected cruise estimates in the field, and adjusting them to a common standard. "Office Compilation" is the job of welding the mass of information obtained by collection and field work into a complete summary of volume and type area data for the entire acreage of forest land within the unit. The "Report" will be an economic discussion of the history and prospects of the timber industry within the counties involved.

The percentages as shown give a fair picture of progress, but do not tell the whole story. Included in the time and money which have been spent on the project thus far, is a large amount for preliminary plans, training of personnel, development of methods and the purchase of cars and field equipment sufficient for an organization of thirty men. The project is now in such shape that it can realize on this investment, especially if the present organization can be held together. Neither do the progress percentages reveal the fact that the most difficult part of the unit has been completed, with respect to the field mapping and compilation. The area covered includes the most broken type conditions, as well as some of the most valuable timber land in the region. The latter class of land naturally deserves more careful consideration than the rough back country areas included in the National Forests. On a large part of the back country, there is already sufficiently accurate coverage and very little, if any, adjustment to Forest Survey standards is needed.

Cover maps for all of the area which has been covered to date are in final form. Photostat negatives have been made of each township. From these, either one-inch or two-inch-to-the-mile reproductions may be made. The plain positive prints show timber and other cover data by lines and type symbols. Colored maps show the above in color, in addition to the symbols. These maps are available at cost for

distribution to those having use for them in township units, in either size, upon order. Considerable use is being made of the two-inch type maps by the A.A.A. and other agencies. The information, while necessarily of an extensive nature, is filling a need for a cover map, of a degree of accuracy which will permit its use for extensive planning or land transactions involving large tracts of low-value land. It is not designed for use where detailed information is desired on small tracts or where high values are involved. Work is also going forward on one-inch-to-the-mile black-line prints, which will be published in units of about 40 townships each, and will show the cover types in more generalized form. These maps will give a good picture of the general cover types of the region.

It is expected that some preliminary statistical data can soon be released. Compilation work has progressed to the point of complete type acreage figures for two counties. Total volume figures are complete in one county, Benewah, in Idaho. These will be released by ownership classes, that is, "Large Private," "Small Private," "State," "County," "Federal," etc. No releases are to be made showing individual ownerships.

L. J. Cummings was selected to head up the growth phase of the survey and much preliminary work was done. Tentative work plans were made covering seven studies on growth and yield in the western white pine, ponderosa pine, larch-Douglas fir, and cedar types.

Forest products production statistics were compiled and the average annual rate of depletion was determined for this phase of depletion, separately by counties, for the region. Additional information was needed for the minor forest products, principally fuel wood and farm fence and pole material, and a survey has been made in North Idaho. Two men have been assigned to the Forest Insect Field Station at Coeur d'Alene to cooperate in making a check survey of the epidemic insect losses, by timber species, separately for the main drainage units within the region.

A preliminary check was made of the fire statistics available and plans formulated for obtaining the average annual loss from this source. Figures on the annual loss in acreage by fires in the different timber types are available over a long period of years. Changes in the type itself and in the stocking of the stands burned over, however, vary greatly with the tensity of the fire. Damage studies are, therefore, necessary in order to arrive at correction factors that can be applied to the forest survey data. Some data on this phase were collected by the field mappers which showed the acreage and volume losses by fire according to the survey type set-up.

Considerable information was obtained on the requirements phase of the Survey through an analysis of the data previously collected through studies of building construction and contractors' records in the larger cities of the Inland Empire, and of the timber requirements of public utilities. A detailed report was made on the wood requirements for the Butte mines. The result expressed in amount of wood used per ton of ore mined and smelted should be applicable to other mining sections of the region. Work on the wood requirements for farm use was initiated in the spring of 1935. A questionnaire was sent out to all the farm owners covered by the detailed CWA canvass of 1934. Additional information was sought on this questionnaire to supplement the data obtained in the original canvass which dealt mainly with the farm home. During June a personal canvass was made of farms scattered through four counties in central North Idaho. In addition to the amounts by kinds of wood used in the construction of the farm buildings, the information on lumber used in repairs and maintenance and the amount of other wood products used on the farm, including fuel, was obtained.

Regular survey funds are sufficient only to pay the salaries and expenses of the three regular members of the staff and meet the obligated share of the Station's overhead expense. Due to the very unsettled financial situation prevailing since April 1935, the emergency crews were not sent into the field until late in June. The present temporary organization includes 17 type mappers, two men on the insect loss survey, two men on growth studies, one man on cutting depletion and requirements, two draftsmen, and one office manager. In addition, there are three detailed Forest officers, and four CCC boys.

With emergency funds now available until the end of September 1935, it is estimated that the present organization will type map in place in the field all of the remaining uncovered areas, in Bonner, Boundary, Spokane, Latah, and Clearwater counties in North Idaho. If usable emergency funds continue to be made available during the next (6th) work period and there is a late fall season, it would be possible with the same organization to complete the type mapping in place in the remainder of the North Idaho counties and do the adjustment cruising in the three northeastern Washington counties. In addition, it would be possible to compile maps in final form for all the area mapped during the field season and do considerable work on office compilation.

With the emergency funds now available, the Insect Loss Survey crew should, during the period July 1 to September 30, 1935, cover approximately half of the North Idaho unit. It is estimated that the survey in the North Idaho unit can be completed if emergency funds continue to be made available for the sixth work period (October 1, 1935 to March 31, 1936).

The larch-Douglas fir yield table study crew should obtain about 30 percent of the field data needed for the table by September 30, 1935. An additional 30 percent of the field data could be collected this field season if emergency funds were made available for the next (6th) work period and the work on office compilation started. A canvass of the wood requirements for farm use can be completed for North Idaho, northeastern Washington, and western Montana with the emergency funds now available.

With the restrictions now in force, it appears improbable that much, if any, of the new ERA funds can be used to continue field work of the kind described above. The allotment per man per year is insufficient to keep the men traveling in the field even though men qualified to do the work could be found on the relief rolls. It is planned to use ERA funds when allotted to build up a map coloring organization and perhaps an office compilation crew.

NRM
Forest Survey
Inland Empire

PROGRESS REPORT

As of: July 1, 1935.

UNIT	Est. Area Forest Land in M. Acres			Percentage of Job Completed				Report
	Inside N. Forests	Outside N. Forests	Total	Collection	Field Mapping	Adj. Cruising	Office Compilation	
IDAHO								
Benewah	16	388	404	100%	100%	100%	90%	
Bonner	446	649	1,095	100%	85%		60%	
Boundary	417	338	755	95%	10%		--	
Clearwater	641	867	1,508	100%	35%		25%	
Idaho	3,490	445	3,935	90%	1%		--	
Kootenai	202	423	625	100%	100%		90%	
Latah	31	400	431	100%	97%		90%	
Lewis		114	114	100%	--		--	
Nezperce		125	125	100%	--		--	
Shoshone	977	634	1,611	100%	59%	100%	40%	
TOTAL IDAHO	6,220	4,383	10,603	97%	37%	18%	29%	
MONTANA								
Deerlodge	60	15	75	90%	--		--	
Flathead	1,843	1,123	2,966	100%	30%		15%	
Granite	620	133	753	75%	--		--	
Lake		442	442	90%	25%		--	
Lewis & Clark	140	80	220	90%	--		--	
Lincoln	1,655	624	2,279	100%	85%		50%	
Mineral	576	164	740	75%	--		--	
Missoula	567	833	1,400	85%	--		--	
Powell	515	390	905	95%	--		--	
Ravalli	928	153	1,081	80%	--		--	
Sanders	822	462	1,284	80%	25%		15%	
TOTAL MONTANA	7,726	4,419	12,145	95%	26%		15%	
WASHINGTON								
Pend Oreille	267	642	909	100%	100%		90%	
Spokane		559	559	100%	100%	100%	95%	
Stevens	64	1,642	1,706	100%	100%		90%	
TOTAL WASHINGTON	331	2,843	3,174	100%	100%	18%	91%	
TOTAL INLAND EMPIRE	14,277	11,645	25,922	95%	40%	10%	29%	

EXPERIMENT STATION PERSONNEL

During the past year, several changes in, and additions to, the regular Station personnel have been made.

The transfer to Washington of I. T. Haig after 12 years of intensive study of white pine silviculture, together with the desirability of reinstating reforestation research at this Station, in order to keep pace with the greatly expanded Regional planting program being started, has necessitated a realignment of personnel in the Section of Silviculture. L. G. Hornby, who has previously had charge of and has completed the first major phase of the exceedingly difficult and complex fire control planning project, is now in charge of Silvicultural Research. R. H. Weidman, who has had charge of the work of this section will now devote his whole time to the reforestation and related phases. Kenneth Davis, who has been field superintendent at Deception Creek since the inception of that Experimental Forest, will be responsible for studies in the white pine type. Two emergency employees, Charles Wellner and George Fisher, will have charge of field crews in silviculture, and Corland James, a 1933 Idaho University graduate, has been made field superintendent of the Deception Creek Experimental Forest.

With the transfer of Mr. Hornby from Fire Research to Silviculture, Mr. Gisborne is being placed in charge of all fire studies, including the hour control project. It is hoped that a suitable man in the associate or full professional grade to specialize in fire control can be selected by next winter.

The small increase in regular funds for the Forest Survey has made possible the selection and appointment of Laurence Cummings to handle the growth phase of this project.

Several changes in the Range Research personnel have been or will be made. The transfer of Fred B. Kennedy to administrative work made possible the selection of E. J. Woolfolk as Superintendent of the Fort Keogh Station, and the material increase in regular funds enabled us to select and appoint Lincoln Ellison to the regular Range Research staff. Tentative plans for the selection of one additional regular range man are now being considered.

The selection of Mr. Bradner to act as the Assistant Director made it necessary that he be relieved of direct responsibility for the Section of Forest Products. I. V. Anderson was, therefore, placed in charge of this section and the position vacated by his promotion has been filled by the transfer of E. F. Rapraeger from the Section of Forest Products at the Pacific Northwest Station.

EXPERIMENT STATION PERSONNEL

The Station personnel as of June 30, 1935, is as follows:

Regular

Lyle F. Watts	Director
M. Bradner	Senior Forester
Leon C. Hurtt	Senior Range Examiner
R. H. Weidman	Senior Silviculturist
I. V. Anderson	Forester
H. T. Gisborne	Silviculturist
G. M. DeJarnette	Associate Forester
Lincoln Ellison	Associate Range Examiner
L. J. Cummings	Assistant Forester
C. N. Whitney	Assistant Forester
Kenneth P. Davis	Junior Forester
G. M. Jemison	Junior Forester
J. B. Thompson	Junior Forester
E. J. Woolfolk	Junior Range Examiner
L. G. Hornby	Regional Forest Inspector
M. J. Pershina	Senior Clerk
L. J. Hinton	Clerk-Stenographer
M. E. Bouchard	Assistant Clerk
Dagmar Duncan	Senior Stenographer

Emergency Work

Name	Title	Status
T. E. Rowland	Associate Forester	Appointed
Eric A. Anderson	Technician	Unappointed
Fred M. Benson	"	Appointed
Gordon T. Cornell	"	"
William W. Ensign	"	"
Herman O. Ficke	"	"
George M. Fisher	"	"
Alfred A. Flint	"	"
Joel Frykman	"	"
Wm. F. Guntermann	"	"
Lester L. Harris	"	"
G. Lloyd Hayes	"	"
Jess M. Honeywell	"	Unappointed
S. Blair Hutchison	"	Appointed
Corland L. James	"	"
Theodore Kachin	"	Unappointed
Elmer R. Marks	"	Appointed
Irwin C. Puphal	"	"
Eric G. Rutquist	"	Unappointed
Charles A. Wellner	"	Appointed

Name	Title	Status
R. J. Smith	Principal Forest Ranger	Appointed
Frank B. Casler	Forest Ranger	"
Joy M. Armstrong	Assistant Technician	"
Adrian Dodge	" "	Unappointed
Howard B. Hawk	" "	Appointed
Joseph N. Hessel	" "	"
Orlo B. Johnson	" "	"
Ralph L. Neafus	" "	Unappointed
A. B. Nugent	" "	Appointed
Carl E. Ostrom	" "	Unappointed
Hans Roffler	" "	Appointed
J. Franklin VanAlsburg	" "	Unappointed
Fred Waylett	" "	"
Ray L. Wrights	" "	Appointed
G. W. Branning	Draftsman	Unappointed
Larry H. Carnall	"	"
Lee Evans	"	"
R. E. Hofland	"	"
James Lynch	"	"
John McMurray	"	"
Eugene V. Wagner	"	"
Stephen Webb	"	"
H. A. Pissot	Jr. Clerk-Stenographer	Appointed
James Hansen	Clerk	Unappointed
Claude Jones	Clerk	"
Mary-Alice McKittrick	Clerk	"
Frank A. Sell	Clerk	"
Orville Skones	Clerk	"
Grayce Tubbs	Clerk	"

PUBLICATIONS

PUBLISHED SINCE LAST REPORT

1. Match Plank from Western White Pine Trees. Anderson, I. V. The Timberman, April 1935.

2. Clean Cutting of Ponderosa Pine Versus Selective Cutting. Anderson, I. V. Journal of Forestry, November 1934, Vol. 32, P. 886.

3. Why Selective Cutting of Ponderosa Pine Pays. Anderson, I. V. The Timberman, September 1934.

4. Application of Selective Logging to a Ponderosa Pine Operation in Western Montana. Anderson, I. V. Bulletin #339 of Univ. of Montana, July 1934.

5. A Comparison of Long-Log and Short-Log Scale. Bloom, C. W. Applied Forestry Note No. 68, May 1935.

6. A Method of Determining Spacing in Thinning. Davis, Kenneth, Journal of Forestry, Vol. 33, January 1935, pp. 80-81.

7. Woodlands Cut by the "Selection Method" Less Liable to Fire Damage. Gisborne, H. T. USDA Yearbook 1934, pp. 376-378.

8. Where Is the Forest Meteorologist? Gisborne, H. T. The Michigan Forester, Vol. XVI, June 1935.

9. When a Normal Is Not Normal. Gisborne, H. T. Bulletin of the American Meteorological Society, Vol. 16, June-July 1935.

10. Shaded Fire Breaks. Gisborne, H. T. Journal of Forestry, Vol. 33, 1935, pp. 86-87.

11. Paired Minimum Temperatures As Indices of Fair or Foul Weather. Gisborne, H. T. Applied Forestry Note No. 65, July 1934.

12. The Rating of Forest Fire Danger. Gisborne, H. T. Applied Forestry Note No. 67, January 1935.

13. Fuel Type Mapping in Region One. Hornby, L. G. Journal of Forestry, Vol. 33, January 1935, pp. 67-72.

14. Regrassing Montana Dry Farms. Hurtt, Leon C. Applied Forestry Note No. 69, June 1935.

15. Regrassing of Dry Farms in Montana. Hurtt, Leon C. The Hereford Journal, December 15, 1934, pp. 34-35.

16. Regrassing "Upside Down" Range Lands. Hurtt, Leon C. Montana Woolgrowers News Letter, January 1, 1935.

17. Overgrazing Reduces Cattle Gains and Increases Production Costs. Hurtt, Leon C. Applied Forestry Note No. 66, July 1934.

18. The Role of Western White Pine in Forest Succession in Northern Idaho. Huberman, M. A. Ecology, April 1935.

19. Beaufort Scale of Wind Force As Adapted for Use on Forested Areas of the Northern Rocky Mountains. Jemison, George M. Journal of Agricultural Research, Vol. 49, July 1, 1934, pp. 77-82.

20. Idaho-Montana Lumber and Timber Products Production. (Preliminary Statement Based on Returns from 1933 Lumber Census) Whitney, C. N. Newspaper and Trade Journal Releases.

SUBMITTED FOR PUBLICATION

1. Selective Cutting Protects Future Value of Farm Woodlot. Anderson, I. V. USDA Yearbook, July 1934.

2. Comparative Germination of Tree Species on Various Kinds of Surface-Soil Material in the Western White Pine Type. Fisher, George M. Ecology, May 1935.

3. Measuring Fire Weather and Forest Inflammability. Gisborne, H. T. Washington Office, February 1934. For Government Circular.

4. Fire Control Objectives and Practices in the Northern Rocky Mountain Region. Gisborne, H. T. and Hornby, L. G. Washington Office for Review as Technical Bulletin.

5. Factors Controlling Initial Establishment in Western White Pine. Haig, I. T. Accepted for Publication as Bulletin by School of Forestry, Yale University, April 1935.

6. Don't Let a "Normal" Deceive You. Hayes, G. Lloyd. Service Bulletin, June 1935.

7. Influence of Weather Factors on Moisture Content of Light Fuels. Jemison, George M. Journal of Agricultural Research, April 1935.

8. Timber Growing and Logging Practice in the Ponderosa Pine Type of the Northwest. Weidman, R. H. USDA Technical Bulletin, June 1934.

9. Idaho-Montana Lumber Production. (Preliminary Statement Based on Returns from 1934 Lumber Census) Whitney, C. N. Newspaper and Trade Journal Releases.

IN PREPARATION OR PROPOSED FOR F. Y. 1936

1. Log Grades for Ponderosa Pine. Anderson, I. V. and Neff, P. The Timberman.

2. Production Costs and Selling Values of Railroad Ties Produced from the Larch-Douglas Fir Stands of Western Montana. Anderson, I. V. Technical Bulletin by University of Montana.

3. Production Costs, Selling Values, and Utilization Facts in the Manufacture of Matches from Western White Pine. Anderson, I. V., Hubert, E. E., and Rapraeger, E. F. Technical Bulletin, University of Idaho.

4. Basic Information for the Practice of Selective Logging in the Ponderosa Pine Forests of the Inland Empire. Anderson, I. V. and Bradner, M. USDA Bulletin.

5. Stumpage Prices Since 1912. Anderson, I. V. Revision of Mimeograph Circular - Applied Forestry Note.

6. Abundance of Inferior Logs Left on Ground After High Grading Experimental Ponderosa Pine Area Results in Heavy Damage to Residual Stand. Anderson, I. V. Applied Forestry Note.

7. The Possibilities of Sustained Yield Forest Management in North Idaho. Bradner, M. Journal of Forestry.

8. Testing the Reliability of Height-Over-Diameter Curves. Davis, K. P. Journal of Forestry.

9. Growth and Yield Data from Permanent Sample Plots in Western White Pine Stands. Davis, K. P. Journal Agricultural Research.

10. Volume Increment on Cut-Over Areas in the Western White Pine Type. Davis, K. P. and Wellner, C. A. Journal of Agricultural Research.

11. Manual on Stand Improvement Methods for the Northern Rocky Mountains. Davis, K. P. and Region One. USDA Miscellaneous Publication.

12. Progress Report on the Forest Resource Survey. DeJarnette, G. M. Applied Forestry Note.

13. Progress Report on the Forest Resource Survey. DeJarnette, G. M. Applied Forestry Note No. 70.

14. Some Effects of the 1934 Drought on Native Vegetation of the Northern Great Plains. Ellison, Lincoln and Woolfolk, E. J. Ecology.

15. Residual Growth on Larch-Fir Cutover Areas in Western Montana. Fisher, George M. Journal of Forestry.

16. Measuring Fire Weather and Forest Inflammibility. Gisborne, H. T. USDA Bulletin.

17. A Ten-Year Record of Lightning Storms and Forest Fires in the Northern Rocky Mountain Region. Gisborne, H. T. Monthly Weather Review.

18. Rating of the Character of the 1935 Fire Season in Region One. Gisborne, H. T. Applied Forestry Note.

19. Reproduction on Cutover Areas in the Western White Pine Type. Haig, I. T. and Wellner, C. A. USDA Bulletin.

20. Natural Reproduction of Western White Pine. Haig, I. T. and Weidman, R. H. USDA Bulletin.

21. Fire Danger Factors by Altitude and Exposure. Hayes, G. Lloyd. Applied Forestry Note.

22. Fuel Type Mapping - Its Relation to Forest Fire Control Planning. Hornby, L. G. Northwest Science.

23. Forest Fire Control Planning in the Northern Rocky Mountain Region. Hornby, L. G. USDA Bulletin.

24. Cattle Production Costs Are Increased by Overgrazing. Hurtt, Leon C. American Hereford Journal.

25. Cattle Production Costs Are Increased by Overgrazing. Hurtt, Leon C. Applied Forestry Note No. 71.

26. Management of Short Grass Ranges of the Northern Great Plains. Hurtt, Leon C. USDA Bulletin.

27. Range Rehabilitation in Montana by Cheap Reseeding Methods. Hurtt, Leon C. Livestock Journal.

28. Effect of Vegetative Condition on Rate of Spread of Fire. Jemison, George M. Journal of Forestry.

29. Erosion Follows the Selway Fires. Watts, Lyle F. Journal of Forestry.

30. The Northern Rocky Mountain Forests; Who Should Own Them. Watts, Lyle F. Journal of Forestry.

31. Some Effects of Climate Upon Forests. Weidman, R. H. Scientific Monthly.

32. Differences in the Progeny of Ponderosa Pine from Various Seed Sources. Weidman, R. H. Journal of Forestry.

33. Treatment of Farm Fence Posts. Whitney, C. N. The Montana Farmer.

34. Durability of Cross-Ties in Montana Test Tracks. Whitney, C. N. Applied Forestry Note.

35. Wood Requirements Per Ton of Copper Ore Mined in Montana. Whitney, C. N. Applied Forestry Note.

36. Forest Statistics Release for Benewah County, Idaho. (From the Forest Survey) Forest Survey Staff.

37. Forest Statistics Release for Spokane County, Washington. (From the Forest Survey) Forest Survey Staff.

38. Forest Statistics Release for Kootenai County, Idaho. (From the Forest Survey) Forest Survey Staff.